

Detection of stunned myocardium in post-reperfusion cases of acute myocardial infarction

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Objective: This study was designed to evaluate the correlation between improvements in serial images obtained by SPECT imaging with Tc-99m MIBI (MIBI) and I-123 BMIPP (BMIPP) and the recovery of cardiac function in acute myocardial infarction (AMI) patients after reperfusion therapy.

Methods: Twenty five patients who were admitted to the emergency room within 24 hours after the onset of the first event of AMI were enrolled in this study. The culprit coronary arteries were identified by CAG and were treated with direct percutaneous transluminal coronary angiography (PTCA), followed by stent implantation. To determine risk areas, initial image at the onset was acquired by the freeze method, in which MIBI was injected before the treatment and the image was collected after the reperfusion therapy. After the reperfusion treatment was completed, MIBI SPECT images at rest were performed on days 7 and 60. Both early and late images, including gated SPECT images were acquired after 30–60 minutes and 6 hours post injection, respectively. In addition, BMIPP SPECT images at rest were obtained 30 minutes after injection of 148 MBq BMIPP on days 7 and 60 (BMIPP image). The obtained image was divided into 48 segments and percent uptake of each segment was calculated. The number of abnormal areas (NAA) was defined as the segment with a % uptake less than 60% of normal uptake, and the change of NAA over time was evaluated. **Results:** The NAA on the MIBI-early image significantly improved between the pre image and the day 7 image ($p < 0.001$), but no similar improvement was observed between day 7 and day 60. On the other hand, the NAA of the MIBI-delayed image did not significantly improve up to day 7, but a slight improvement was observed on days 7 and 60 ($p < 0.05$). A significant improvement in the NAA of the BMIPP image was observed between day 7 and day 60, as shown in the delayed image ($p < 0.05$). An excellent correlation on the NAA between the MIBI-delayed image and the BMIPP image was observed with $r = 0.983$ ($p < 0.001$) at day 7 and $r = 0.984$ ($p < 0.001$) at day 60 resulting in a consistent diagnosis. Analysis of the myocardial function by means of gated SPECT indicated that the wall motion significantly improved as the myocardial perfusion improved up to day 7 and thereafter a steady improvement was observed up to day 60. The improvement in the NAA in MIBI-delayed images in the subacute phase (day 7) and in the chronic phase (day 60) as well as BMIPP images showed excellent correlation with the improvement in RWM and RWT (MIBI-delayed image: $r = 0.550$ (RWM), $r = 0.647$ (RWT)), (BMIPP image: $r = 0.536$ (RWM), $r = 0.565$ (RWT)). **Conclusion:** We conclude that insufficient ATP production caused by mitochondrial dysfunction in stunned myocardium is closely related to MIBI delayed and BMIPP images. Furthermore, MIBI delayed imaging as well as BMIPP imaging will provide a clue to the state of stunned myocardium after reperfusion therapy in patients with AMI.

Key words: Tc-99m MIBI, reverse redistribution, reperfusion, stunned myocardium, risk area